

CLAIMS

- 1 - Method for determining blood recirculation in a vascular access (11) of a patient undergoing a dialysis treatment by means of a dialysis machine (10) comprising a collecting line (24) for withdrawing blood from the patient's body, a dialysis filter (16), and a return line (26) for returning blood into the patient's body, the recirculation taking place in the vascular access between the return line (26) and the collecting line (24), characterized in that it comprises the steps of:
- inducing, in the blood flowing in the return line (26), a disturbance of a magnitude such as to bring the system into a transient state; and
 - determining blood recirculation in the vascular access (11) during the transient state as a function of the magnitude of the disturbance induced in the collecting line (24).
- 2 - Method according to claim 1, characterized in that the step of inducing a disturbance in the blood flowing in the return line (26) comprises the step of causing a variation of the haemoglobin concentration of the blood flowing in the return line (26).
- 3 - Method according to claim 2, characterized in that the step of causing a variation of the haemoglobin concentration of the blood comprises the step of controlling a variation of ultrafiltration flow in the dialysis filter (16).
- 4 - Method according to claim 2 or 3, characterized in that the step of inducing a disturbance in the blood flowing in the return line (26) comprises the step of causing a succession of changes of haemoglobin concentration of the blood flowing in the return line (26).

5 - Method according to claim 4, characterized in that it further comprises the steps of:

- acquiring, for each variation, the value of the haemoglobin concentration of the blood flowing in the return line (26) and at the same time the value of the haemoglobin concentration of the blood flowing in the collecting line (24); and
- determining the recirculation in the vascular access as a function of the values of the haemoglobin concentration of the blood that were acquired relating to the variation and to temporally preceding variations.

6 - Method according to claim 5, characterized in that the step of determining the recirculation in the vascular access comprises the step of calculating the recirculation by modeling the system by means of a linear first order model whose parameters are estimated using the method of least squares.

7 - Device for determining blood recirculation in a vascular access (11) of a patient undergoing a dialysis treatment by means of a dialysis machine (10) comprising a collecting line (24) for withdrawing blood from the patient's body, a dialysis filter (16), and a return line (26) for returning blood into the patient's body, the recirculation taking place in the vascular access between the return line (26) and the collecting line (24), the device being characterized in that it comprises:

- means for inducing, in the blood flowing in the return line (26), a disturbance of a magnitude such as to bring the system into a transient state; and
- means for determining blood recirculation in the vascular access (11) during the transient state as a function of the magnitude of the disturbance induced in the collecting line (24).

8 - Device according to claim 7, characterized in that the means for inducing a disturbance in the blood flowing

in the return line (26) comprises means for causing a variation of the haemoglobin concentration of the blood flowing in the return line (26).

- 5 9 - Device according to claim 8, characterized in that the means for causing a variation of the haemoglobin concentration of the blood comprises means for controlling a variation of ultrafiltration flow in the dialysis filter (16).
- 10 10 - Device according to one of the claims 7 to 9, characterized in that the means for inducing a disturbance in the blood flowing in the return line (26) comprises means for causing a succession of changes of
- 15 haemoglobin concentration of the blood flowing in the return line (26).
- 11 - Device according to claim 10, characterized in that it further comprises:
- 20 • means for acquiring, for each variation, the value of the haemoglobin concentration of the blood flowing in the return line (26) and at the same time the value of the haemoglobin concentration of the blood flowing in the collecting line (24); and
- 25 • means for determining the recirculation in the vascular access as a function of the values of the haemoglobin concentration of the blood that were acquired relating to the variation and to temporally preceding variations.
- 30 12 - Device according to claim 11, characterized in that the means for determining the recirculation in the vascular access comprises means for calculating the recirculation by modeling the system by means of a linear first-order model whose parameters are estimated using
- 35 the method of least squares.